CLAIMS

What is claimed is:

1. A binocular viewing system comprising:

a nose bridging element arranged over the user's nose; and

a right eye display assembly and a left eye display assembly, each comprising:

an electronic display element operative to provide an image, and

an optical pipe element comprising a transparent pipe and an eyepiece assembly, the transparent pipe arranged to relay light internally from the electronic display element to the eyepiece assembly; and

an interpupillary adjustment mechanism configured to movably mount the right eye display assembly and the left eye display assembly to the nose bridging element to adjust a spacing between the eyepiece assembly of the right eye display assembly and the eyepiece assembly of the left eye display assembly, whereby an interpupillary distance between the user's eyes can be accommodated.

2. The binocular viewing system of claim 1, wherein the nose bridging element comprises a rail element, and the interpupillary adjustment mechanism comprises a sliding member disposed on each optical pipe element and configured to slide along the rail element.

3. The binocular viewing system of claim 2, wherein the rail element includes an elongated recess therein, and the sliding members are retained within the recess for sliding movement along the recess.

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4. The binocular viewing system of claim 3, wherein the sliding members include an elongated dovetail projection and the elongated recess has a mating configuration to receive the dovetail projection.

5. The binocular viewing system of claim 2, further comprising a biasing mechanism disposed between the sliding member and the rail element.

6. The binocular viewing system of claim 5, wherein the biasing mechanism comprising a compression spring mechanism.

7. The binocular viewing system of claim 1, wherein the interpupillary adjustment mechanism is fixed to the optical pipe elements.

8. The binocular viewing system of claim 1, wherein the interpupillary adjustment mechanism is integral with the optical pipe elements.

9. The binocular viewing system of claim 1, wherein the interpupillary adjustment mechanism and the optical pipe elements comprise a single injection molding.

10. The binocular viewing system of claim 1, wherein the interpupillary adjustment mechanism and the optical pipe elements comprise an optical plastic material.

11. The binocular viewing system of claim 1, wherein the optical pipe elements are mounted so that optical axes of

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each of the eyepiece assemblies are arranged to provide a stereo image to the user.

12. The binocular viewing system of claim 1, wherein the interpupillary adjustment mechanism is arranged to move the optical pipe elements in a direction perpendicular to the user's line of sight when gazing at a distant object.

13. The binocular viewing system of claim 1, wherein the nose bridging element is disposed within a housing.

14. The binocular viewing system of claim 1, further comprising temple pieces attached to the right eye and left eye display assemblies.

15. The binocular viewing system of claim 14, further comprising audio transducers attached to the temple pieces.

16. The binocular viewing system of claim 14, further comprising a microphone attached to at least one of the temple pieces.

17. The binocular viewing system of claim 1, further comprising a pair of nose pieces attached to the nose bridging element.

18. The binocular viewing system of claim 1, further comprising a frame and lenses mounted to the nose bridging element between the right eye and left eye display assemblies and the user's eyes.

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19. The binocular viewing system of claim 18 wherein the lenses comprise corrective lenses for the user's vision.

20. The binocular viewing system of claim 18, wherein the frame includes a detachable lens retaining element configured to removably retain lenses therein.

21. The binocular viewing system of claim 1, wherein the right eye display assembly and the left eye display assembly each further include a focusing adjustment mechanism.

22. The binocular viewing system of claim 21, wherein the focusing adjustment mechanism comprises a mechanism configured to movably mount each of the electronic display elements with respect to each of the associated optical pipe elements.

23. The binocular viewing system of claim 21, wherein the focusing adjustment mechanism comprises a mounting fixture disposed to mount each electronic display element to an end of each of the associated optical pipe elements.

24. The binocular viewing system of claim 23, wherein each mounting fixture comprises a carrier mounted for linear motion within a housing, the electronic display element fixed within the carrier, a rotatable lead screw fixed to the carrier via a transmission element to convert rotation of the lead screw to linear motion of the carrier within the housing.

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25. The binocular viewing system of claim 1, wherein the optical pipe elements include a cavity for retention of circuitry or wiring connecting the electronic display elements.

26. The binocular viewing system of claim 1, wherein the nose bridging element includes a cavity for retention of circuitry or wiring connecting the electronic display elements.

27. The binocular viewing system of claim 1, further comprising temple housings disposed at ends of the right eye and left eye display assemblies, cavities formed in the temple housings to hold the electronic display elements and service loops of circuitry or wiring.

28. The binocular viewing system of claim 1, wherein the transparent pipe of the optical pipe element further includes two optical surfaces arranged to permit passage of ambient light through the two optical surfaces toward the user's eye.

29. The binocular viewing system of claim 1, wherein the eyepiece assembly of each optical pipe element comprises a turning mirror and an eyelens arranged to direct light toward the eye.

30. The binocular viewing system of claim 1, wherein the eyepiece assembly of each optical pipe element comprises a polarization beam-splitter coating, a quarterwave plate, and a focusing mirror arranged so that polarized light from the display assembly passes the beam-splitter coating

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and the quarterwave plate and is reflected from the focusing mirror to pass in the opposite direction through the quarterwave plate and is reflected from the beam-splitter coating toward the eye.

31. The binocular viewing system of claim 1, wherein the right eye display assembly and left eye display assembly are arranged in a curved configuration to accommodate curvature of a user's face.

32. A binocular viewing system for accommodating a range of interpupillary distances, comprising:

a right eye display assembly and a left eye display assembly connected by a nose bridging element, each display assembly comprising:

an electronic display element operative to provide an image, and

an eyepiece assembly comprising an optical pipe element and a surface arranged to relay light from the electronic display element toward an eye of a user;

wherein the right eye display assembly and the left eye display assembly are disposed with respect to each other to converge rays from each eye of the user on a virtual image provided at a distance less than optical infinity.

33. The binocular viewing system of claim 32, wherein each of the electronic display elements of the right eye and left eye display assemblies is displaced laterally from its optical axis, thereby providing left and right

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virtual images at a convergence distance less than infinity.

34. The binocular viewing system of claim 32, wherein each of the electronic display elements is movably mounted by the binocular viewing system.

35. The binocular viewing system of claim 32, wherein each of the eyepiece assemblies is movably mounted by the binocular viewing system.

36. The binocular viewing system of claim 32, wherein each eyepiece assembly includes an eyelens selected to minimize off-axis aberrations.

37. The binocular viewing system of claim 36, wherein the eyelens includes an aspherical lens.

38. The binocular viewing system of claim 36, wherein the diameter of the eyelens is selected to accommodate a range of interpupillary distances.

39. The binocular viewing system of claim 32, further comprising a focal adjustment mechanism.

40. The binocular viewing system of claim 32, wherein the right eye and left eye display assemblies are adjustably mounted with respect to each other to adjust a distance between the user's eyes and the right eye and left eye display assemblies.

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41. The binocular viewing system of claim 32, wherein the right eye display assembly and the left eye display assembly are connected by a pivoting connection at the nose bridging element, the pivoting connection operative to adjust the angular orientation of the optical axis of each of the display assemblies with respect to the user's eyes.

42. The binocular viewing system of claim 32, wherein the surfaces of each eyepiece assembly are arranged with respect to each other to converge rays from each eye of the user on a virtual image provided at a distance less than optical infinity.

43. The binocular viewing system of claim 32, wherein the nose bridging element comprises an optical pipe element connecting the right eye display assembly and the left eye display assembly.

44. The binocular viewing system of claim 32, wherein each eyepiece assembly is suspended from a support, the electronic display element affixed directly to the eyepiece assembly at the support.

45. The binocular viewing system of claim 44, further comprising circuitry or wiring in communication with the electronic display element disposed on the support.

46. The binocular viewing system of claim 32, wherein the right eye display assembly and the left eye display assembly each include an optical pipe element disposed to

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transmit light from the electronic display element to the eyepiece assembly.

47. The binocular viewing system of claim 32, wherein the nose bridging element comprises an optical pipe aligned with the optical pipes of the right eye display assembly and the left eye display assembly.

48. The binocular viewing system of claim 47, wherein the optical pipes of the right eye display assembly and the left eye display assembly are curved to accommodate curvature of a user's face.

49. The binocular viewing system of claim 32, wherein the right eye and left eye display assemblies are mounted on a frame configured to be supported by a user's head.

50. A binocular viewing system comprising:

an optical pipe element having a curvature to accommodate curvature of a user's face, a mid portion of the optical pipe element forming a nose bridging element;

a right eye display assembly and a left eye display assembly, each display assembly comprising:

an electronic display element operative to provide an image disposed to transmit light into an end of the optical pipe element,

a portion of the optical pipe element disposed to receive light from the electronic display element, and

an eyepiece assembly comprising an eyelens and at least one reflective surface, the reflective surface disposed within the optical pipe element to

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relay light in the portion of the optical pipe element toward an eye of the user.

51. The binocular viewing system of claim 50, wherein the optical pipe element is solid and transparent.

52. The binocular viewing system of claim 50, wherein the optical pipe element is hollow.

53. The binocular viewing system of claim 50, wherein each display assembly further includes an optical wedge provided between the eye lens and the optical pipe element on an optical path from the reflective surface to the eyelens, the optical wedge configured to provide an axial optical system from the electronic display element to the eye lens.

54. The binocular viewing system of claim 50, wherein the eye lens of each display assembly is located at a temple end of the optical pipe element.

55. The binocular viewing system of claim 50, wherein the electronic display element is spaced from the eye lens by a distance approximately equal to a focal length of the eye lens.

56. The binocular viewing system of claim 50, each display assembly further comprises an optical wedge on an external surface of the optical pipe element on an optical path from the reflective surface to the eye, the optical wedge configured to provide an axial optical system between the electronic display element and the eye.

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57. The binocular viewing system of claim 56, wherein the optical wedges of each display assembly are integrally connected to extend across a portion of the optical pipe element.

58. The binocular viewing system of claim 52, wherein each eyepiece assembly comprises a plurality of reflective surfaces disposed within the optical pipe element to relay light in the portion of the optical pipe element toward an eye of the user, whereby a wide field of view is provided.

59. The binocular viewing system of claim 52, wherein the optical pipe element, the right eye display assembly, and the left eye display assembly are attached to temple pieces configured to be supported by a user's head.

60. A binocular viewing system comprising:

an optical pipe element, a mid portion of the optical pipe element forming a nose bridging element; and

a right eye display assembly and a left eye display assembly, each display assembly comprising:

an electronic display element operative to provide an image, the electronic display element disposed within a portion of the optical pipe element, circuitry or wiring connected to the electronic display element passing along an upper or lower surface or in a cavity of the optical pipe element, and

an eyepiece assembly comprising an eyelens and at least one at least partially reflective surface, the reflective surface disposed within the optical

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pipe element to relay light from the electronic display element toward an eye of the user.

61. The binocular viewing system of claim 60, wherein the at least partially reflective surface comprises a mirror.

62. The binocular viewing system of claim 60, wherein the at least partially reflective surface comprises a polarization beam splitter disposed to transmit illumination from an illumination source along the optical pipe element to the electronic display element, the electronic display element being reflective to return light to the surface, the surface operative to reflect light to the eyelens.

63. The binocular viewing system of claim 60, further comprising an illumination source for the electronic display element disposed to provide illumination from an end of the optical pipe element.

64. The binocular viewing system of claim 63, further comprising a collimating lens disposed within or on an end surface of the optical pipe element to collimate light from the illumination source to the electronic display element.

65. The binocular viewing system of claim 60, further comprising an illumination source for the electronic display element disposed adjacent to the electronic display element.

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66. The binocular viewing system of claim 60, wherein the eyelens minimizes aberrations.

67. The binocular viewing system of claim 60, wherein the optical pipe element is formed of polymethylmethacrylate, polycarbonate resin, epoxy resin, urethane, cyclo-olefin, or glass.

68. The binocular viewing system of claim 60, wherein the optical pipe element, the right eye display assembly, and the left eye display assembly are attached to temple pieces configured to by supported by a user's head.

69. The binocular viewing system of claim 60, wherein the electronic display element of each display assembly is disposed with the nose bridging element of the optical pipe element.

70. The binocular viewing system of claim 69, further comprising an illumination source for the electronic display element disposed within the nose bridging element of the optical pipe element.

71. The binocular viewing system of claims 1, 32, 50 or 60, wherein the electronic display elements are in communication with a source of image data.

72. The binocular viewing system of claim 71, wherein the source of image data comprises a television, a digital video disc player, an MPEG4 player, a camcorder, a digital camera, a video tape player, a personal computer, a personal digital assistant, or a cellular telephone.

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73. The binocular viewing system of claim 32, 50, or 60, further comprising a frame and lenses mounted to the nose bridging element between the right eye and left eye display assemblies and the user's eyes.

74. The binocular viewing system of claim 73 wherein the lenses comprise corrective lenses for the user's vision.

75. The binocular viewing system of claim 73, wherein the frame includes a detachable lens retaining element configured to removably retain lenses therein.

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